THE NATIONAL SHIPBUILDING RESEARCH PROGRAM

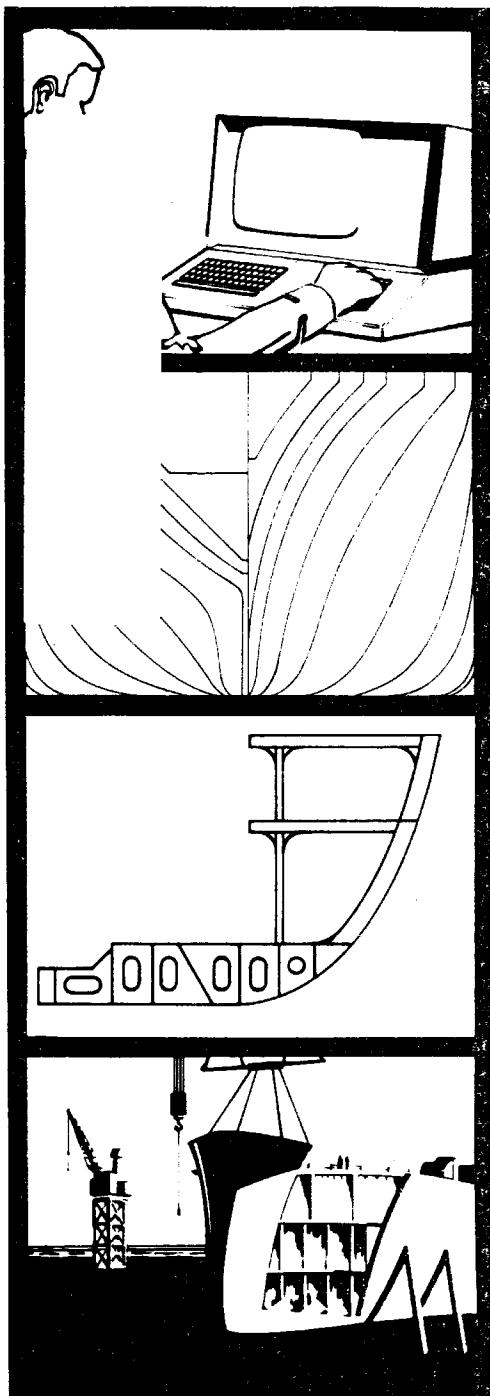## Proceedings of the REAPS Technical Symposium

Paper No. 22:
Recent Developments in Computer-Based Systems at Kockums

U.S. DEPARTMENT OF THE NAVY
CARDEROCK DIVISION,
NAVAL SURFACE WARFARE CENTER

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Prescribed by ANSI Std Z39-18

DISCLAIMER

R ESEARCH
AND
E NGINEERING
FOR
A UTOMATION
AND
P RODUCTIVITY
IN
S HIPBUILDING

Proceedings of the

REAPS Technical Symposium

June 21-22, 1977

New Orleans, Louisiana

RECENT DEVELOPMENTS IN COMPUTER BASED SYSTEMS

AT KOCKUMS

Kai Holmgren
Kockums Computer Systems AB
Malmo, Sweden

As the Director of Kockums Computer Systems, Mr. Holmgren is respon-
sible for all its activity (development of systems, marketing, computer
production, etc.). He has been with Kockums in various positions since
1961. Before that time, he was in charge of technical systems development
at the Swedish Aeroengine Company.

KOCKUMS

THE KOCKUMS GROUP

Shipyard	Ships Submarines
Shipping	Ship operations
Computer Systems	Computer based systems Computer operations System services
Industries	qf highwaj@qcAk4;. *rnp trucks tiggin twhicles "and systemd~, Sqwmi] fequipment and systefi
Automation	Marine electronics Acoustic signalling equipment Sawmill electronics Electronic lifting devices
Chemical	Biochemical indicators
Construction	Feed-stuff plants Installations for powdered materials
Energy Systems	Heat and power production plants District heating systems System components

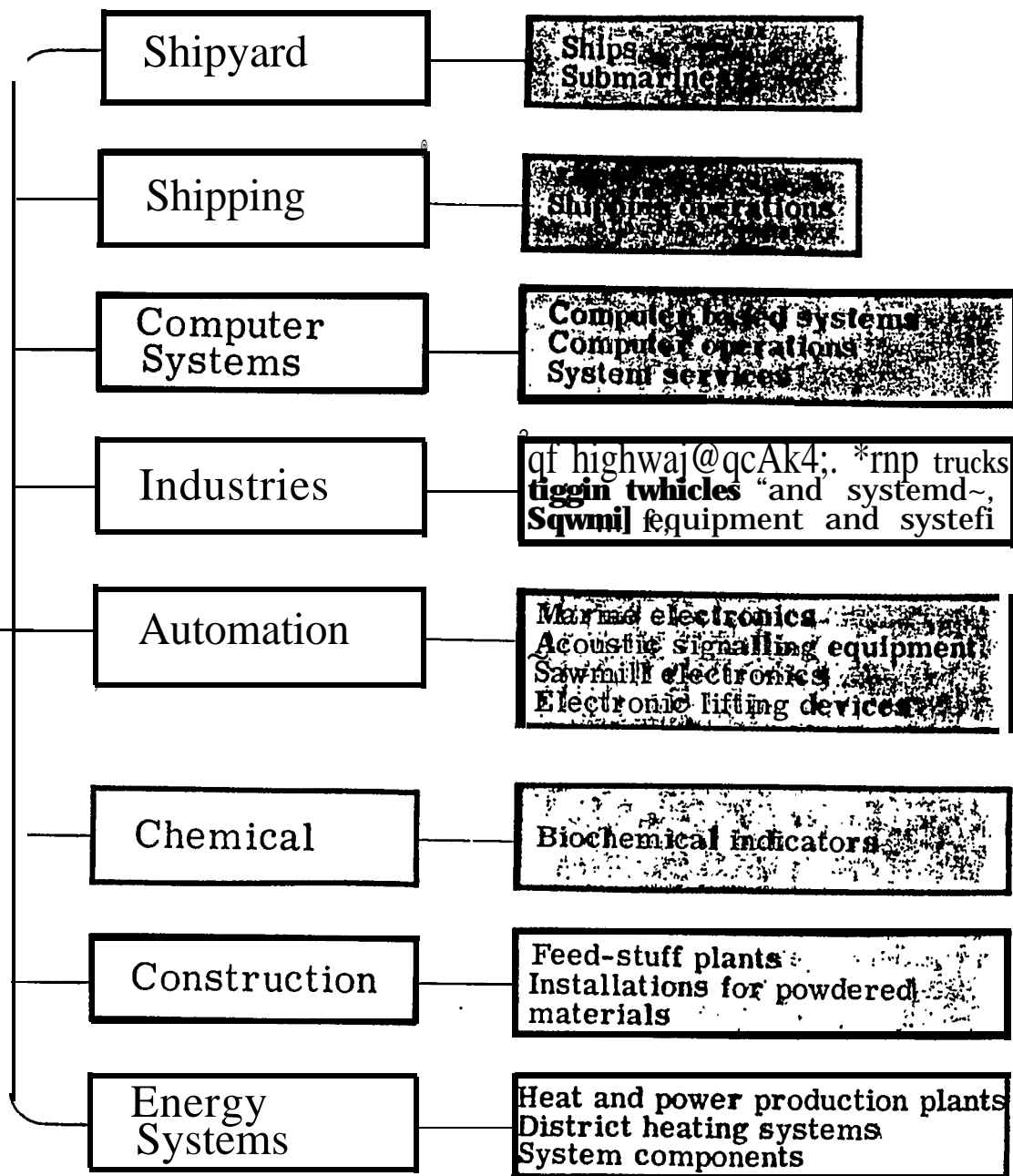**KOCKUMS AB**

Group Staff
- Finance
- Personnel
- Legal
- etc

Employees 1977

\\\.8.000

Turnover 1976

.430 million dollars

Information System
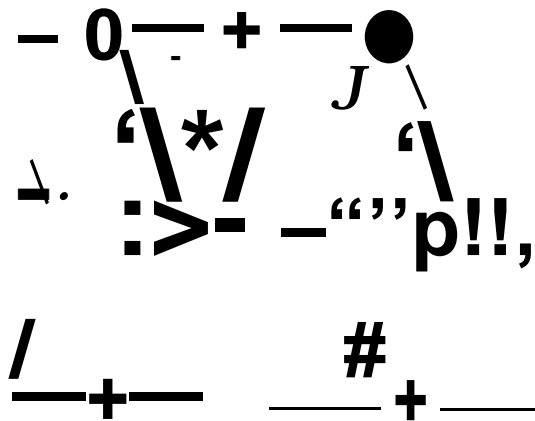
- **Stations** (Departments, persons, machines etc)

  producing
  consuming
  handling   information

- **Transportation ways**

- **Information media** (documents, files, data bases etc)

Computer- based *Information System*

- Network covering the main activities of a company

- A major part of the activities are covered by computer applications

- The individual computer applications are designed so that they can "talk" to each other

Characteristics of Shipbuilding

● Tailor-made product

● Short series

● All activities concentrated around
  one complicated and expensive product

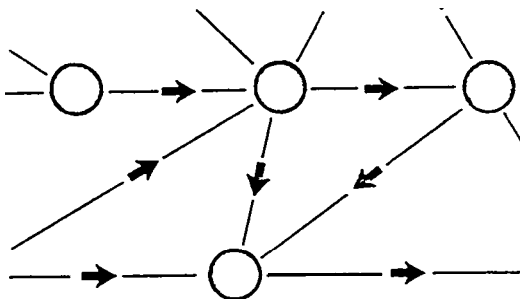● Different types of design activities
  (Hull, out-fitting machinery)

. Different types of production

. Heavy product requiring extensive areas,
  transportations and lifting

● Much work done out-doors

. Steel is costwise almost 50 ‰ of the
  total material

Information Structure
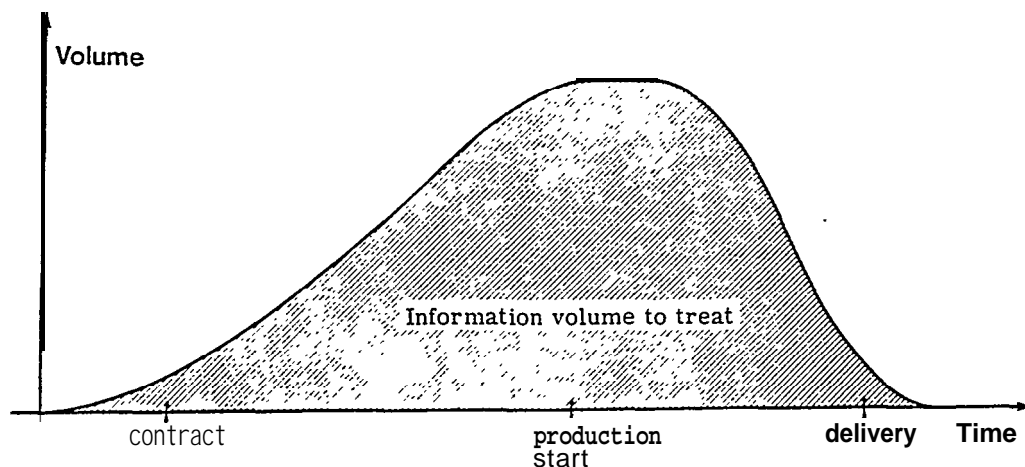
● Large volumes of design and work
  preparation information (short series)

● Material information and standardization
  very vital.

. The overall planning and follow-up is very
  essential (a ship represents a big and
  complicated project)

✕KOCKUMS

Survey SYSTEM

Production preestimation → **Central planning**

Central planning — Building prog. → **Detailed planning**

Detailed planning — Worked up hours → Central planning

Follow-ups (hours and prognoses)

Building prog.

Building prog.

Workshop order

Detailed production plans

Work concluded

Materials Administration

Consumption → **Design and work preparation**

Purchase request Materials reservation

Order sets

Design work concluded

Personnel Administration

Material follow-ups

Costs of Material

Design planning and follow-ups

Personnel costs

Pay Specifications

Pre-calculation Budgets → **Financial affairs** → Financial follow-ups with prognoses and cost accounts

369

KOCKUMS

Display screen terminal

Inquiry / Dialogue

- Material status

- Work status

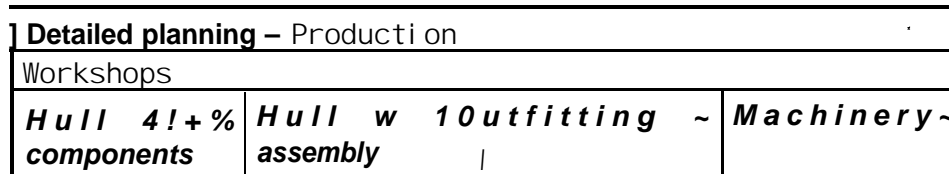- Resource planning

- Plate and profile administration

- Work preparation

- Financial accounting

- . . . .

The planning function

Central planning	

I Detailed planning – design	
Drawing offices	

Hull P	Electrical F	Outfitting W	Machinery F

] Detailed planning – Production	
Workshops	

Hull 4!+% components	Hull w 1 0utfitting ~ assembly	Machinery~
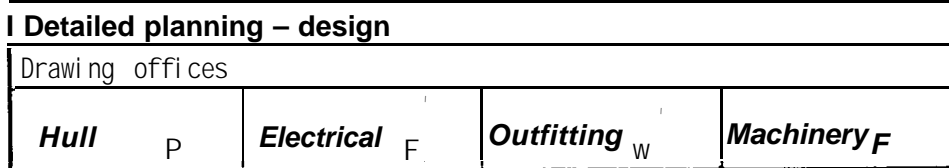
Planning levels for production

Planning units 1,000

Workshop orders 8,000

Jobs 80,000
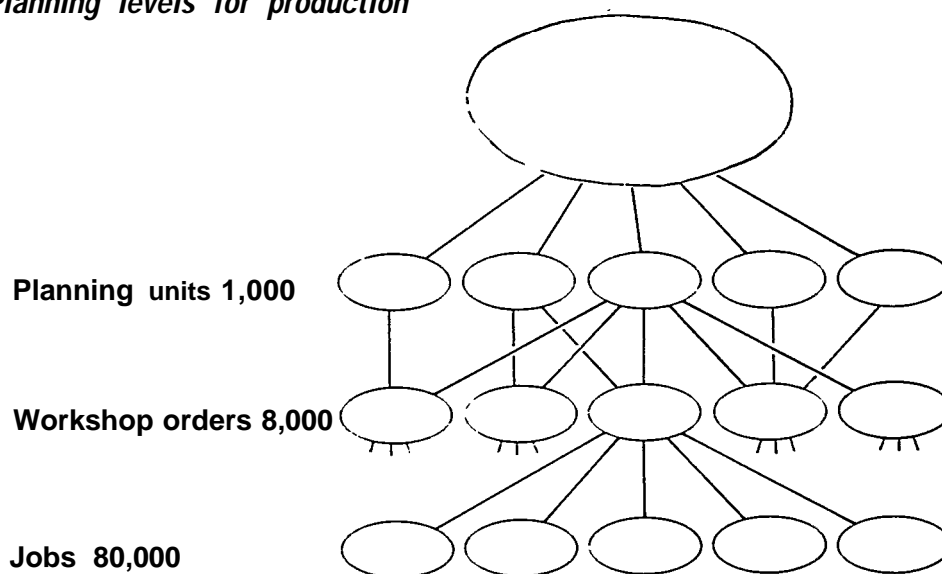
KOCKUMS

KOCKUMS MEKANISKA VERKSTADS AB
OH303A
WORK CENTRE: 729   -736

730827   WORKLOAD SCHEME

Work load diagram

```
A    510538  120|   B. B
B    510541     |   B. B
C    510542     |   B. B
D    510543     |   B. B
E    510544     |   B. B
F    510545  105|   B. B
G    510546     |   B. B
H    510547     |   B. B
I    510548     |   B. B
J    510549     |   B. B
K    510550   90|   B. B
L    510551     |   B. B
```

A complex ASCII work-load histogram with columns labelled across the bottom:

```
SCALE  3
       332  334 -- 336  338  340  342  344  346  348  350  352  402  404  406  408
```

X KOCKUMS
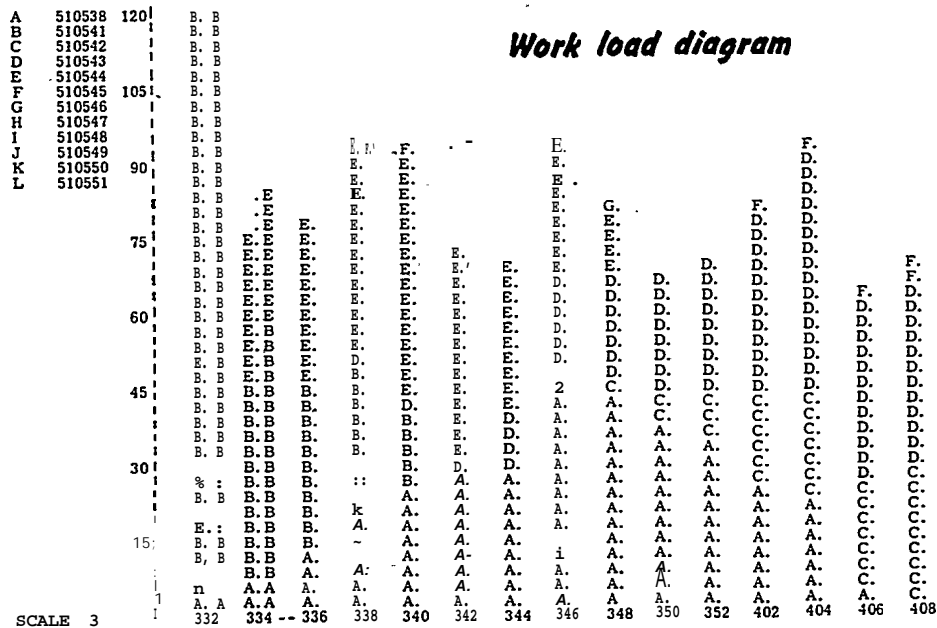
Conversion of a network into a building programme

F "" PRODucT   s o 510-549
                                           PAGE: 25

TYPE NO ICSELLAY FLOA OIJTDOCK DESWXVEXKY

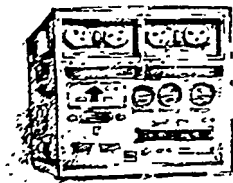|	DELIVERY WEEK	
	DRAW-INGS	MA-TERIALS
SECTION OUTFITTIMi		
CARGOPART D SECTIOX		
48024 D796BB READY-hL4DE FOR SEC OLTF	---	515
FOREBODY		
2D02 FOREBODY OLTF. IN HULL DEPT	446	504
2003 El 391 SEC OUT	501	509
2004 B 991 READY-h2ADE FOR SEC OUTF	---	513
69501 PIPETOWER	446	504
69502 PIPETOWER READY-MADE	---	506
Deckhouses		
71302 H702 SEC OUTF	503	511
71304 H702 READY-MADE FOR SEC OuTFF	---	513
71503 H703SB SEC OUTF	502	510
71504 H'i03SB READY-MADE FOR SEC OUTF	---	510

372

KOCKUMS

50,000 kinds of materials
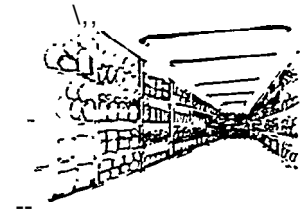
10,000 (stock materials)
*Ordered by
the computer*

40,000 (direct materials)
*Ordered by
the designer*

KOCKUMS

OK

**Alarm
list**

Computer — control of delivery times
against building programme

Purchase orders

Supplier

**Materials
Administration**
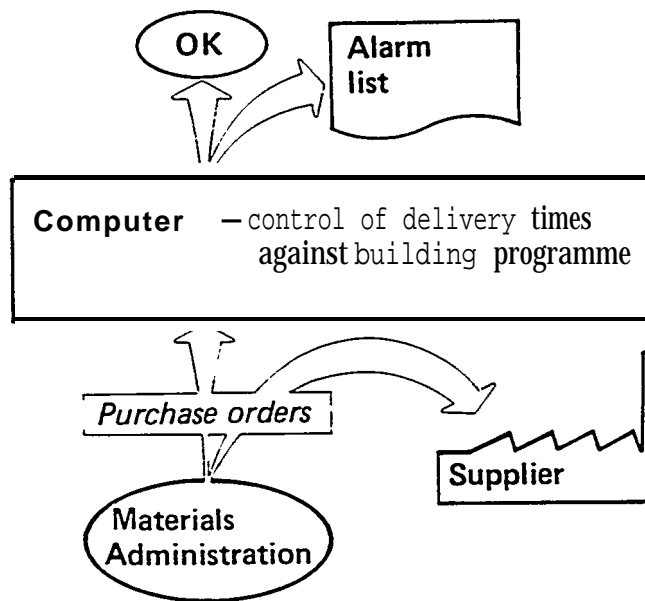
Purchase requests

![Kockums logo] **KOCKUMS**

Reminder of non-delivery

KOCKUMS

b.a.nc'. o :C, c...titw.w
PAMINNEME OM u7eeuvTN LEWRANE
REMINOER OP NON-OEUVERY
,... - k   . . — o . .
73-09-07   T   AHLM
- - -   .0 .
371000   39 1972
. ..- .-
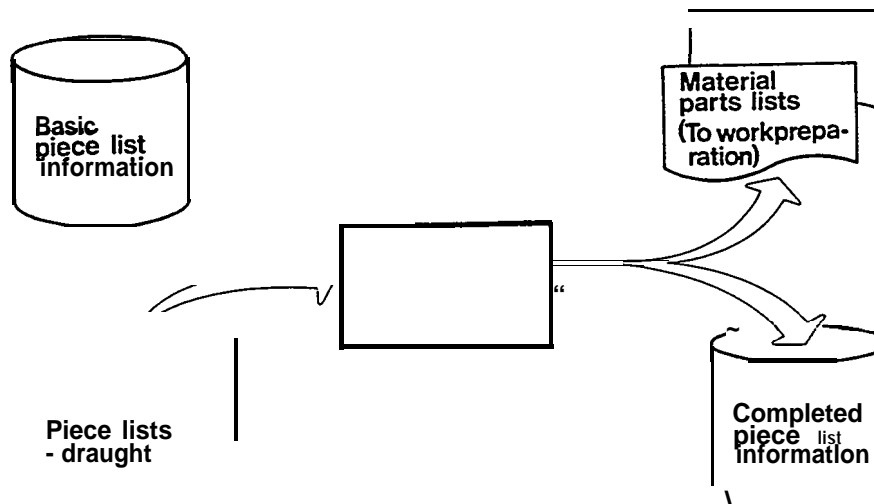
BEEVARAS OMGAENDE

ANVAND BIFOGAT LEVERANSBESKED
SOM SVARSBLANKETT.

DE MED ASTERISK (*) MARKERADE
RADERNA IFYLLES AV ER.

FOR IMMEDIATE ANSWER

WHEN ANSWERING PLEASE USE NOTICE
OF DELIVERY ATTACHED.

LINES MARKED WITH AN ASTERISK (*)
ARE TO BE FILLED UP BY YOU.

KABELHJO VETA A/S

POSTBOX XYZ
            53400 OSLO

NORGE

KOCKUMS MECANGRA VERKSTADS AB

Material No.

Week of delivery

RULLKLYS TYP 3 ENKELT MED 150 MM RULLE   **Product No.**

4,00 ST   34 1973 441 00 857 001108   2   510544 23300 45016

Answer from the supplier

![Kockums logo] **KOCKUMS**

Data bank for piece list information

Basic piece list information

Material parts lists (To workprepa- ration)

Piece lists - draught

Completed piece list information

KOCKUMS

Piece list — draught

Callout box:
- **Id. of piece lists on a lower level**
- **Id. of materials**
- **Drawing No.**

VENTILATION OF ACCOM. A-DECK SB

KOCKUMS

Operation list

WO, OPERATION LIST

```
200  56  7946  10            4135.00 KR   06  52
   PLAC. OF ALL VENT. PIPES AND DETAILES
   TOTAL LENGTH = 355 M AND FITTING, PLAC. AND WELDING OF
   ABOUT 400 HOLDERS. PLAC. OS SPINDLE LENGTHENING TO
   DAMPER POS. 53 (VALID FOR C-DECK)

210  56  7946  10            3955.00 KR   06  52
   PLAC. OF ALL VENT. PIPES AND DETAILES
   TOTAL LENGTH = 344, 0 M AND FITTING, PLAC. AND WELDING
   OF ABOUT 355 HOLDERS (VALID FOR D-DECK AND NAV. DECK)

211  56  7946  10            118.00 KR    06  52
   INST. OF
   FANBO

220  56  7
   CO
   HOL
   AND
   WITH
   ALSO
   AND
   PLAC.

221  56  7951
   WELDING OF
   PLAC. OF

75451  76075
```

One operation

200   56   7946   10   4135.00 KR   06

PLAC. OF ALL VENT. PIPES AND DETAILES

- **Production group**
- **Department No.**
- **Operation No.**
- **Operation descr.**
- **Estimate**

|				
H 701 VENTILATION OF ACCOMMODATION	517:3	K-EH	1860	1 273 65361
DRAW. DISTR. SEE OP. 350 WO 517 1 7565 BRI			711	510552 273 30129

Order-set–material requisition

- ●**Product** No.
- ●**Planning unit**
- ●**Reference No.**
  with check digit

- ●**Material No.**
- ● Planned quantity
- ● Required quantity
  (filled in manually)

The form reads approximately:

```
R R R R R R R R   REQUISITION   R R R R R R R R   R R R R R R R R   R R R R R R R R
R R R R R R R R                 R R R R R R R R   R R R R R R R R   R R R R R R R R
VENTILATION OF ACCOM. A-DECK SB      Plant  273  Vara 65361  Pie 71152  510552
273 30129                         00  0000  00 00      Kp              311  4249  0
   53 1660 100 [ 00110008311 XXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXX
AM*,   Ild  lb  Iklb*i&!;  lb  ivlhfu  lrlmdhw  iK..MilMa-.f4*   K.+ fillb ,w+g
   2106 156 I L 12001273 I        1200.00 mmlh'm'11      1    1    1    ,    ,    1
% ; %  R. BAR 15 COMPR. TOL. 1S0 H 10 VT
       L = 600
L=.%   MATRL. GRP. 1231 LOCATION 700000
%
* ~
I,d
     ( v - ; , - )  [?.AI  1.!1-  Cm, I.* =1- .! - m-)   (w C" ,e)  m:-,-.+,)  (m...a"$)-)  w = + . )
                          -Ydl
```

KOCKUMS

The planning function

Central planning

Detailed planning – production

workshom

*Hull w! Hull ~ Outfitting ##~ Machinery ~
/ components / assembly   '1*

KOCKUMS

Detailed plan for Workshops

KOCKUMS MEKANISKA VERKSTADS AB OUTFITTING QD1128					PRODUCTION PROGRAMME ① DEPT 734 ORDERDISTRIBUTION AREA 911 73-03-23					
PRODUCT NUMBER	WORK SHOP ORDER	PLAN UNIT	JOB ②	PROD GROUP	PLAN HOUR ③	CA-PACITY	START	FIN-ISHED ④	STATUS	WORK ORDER DESIGNATIO
510539	59674	45015	10- 20	7046	16.7	0.8	73061	73085	8ᴘ	ou'rD3CNt.
510540	56848	32603	10- 20	7946	11.2	0.8	73081	73084	P	G 402 PLAC
510540	57093	32603	10- 20	7946	10.9	0.8	73 08]	73084	P	~ \;2&Yh;R
510540	44327	24513	40	7946	3.0	1.0	73082	73095		
510539	57179	71398	50- 70	7046	16.1	0.2	73082	73105	P	H-702 OUt
		REMAINING HOURS WEEK 7308 289						ACCUMULATED		˙1408
510539	55410	62703 140- 150		7946	16.0	1.1	_ 73091	_ _73094	_ _ _ _ _	8903 DIDT I
510539	56960	38603 30- 70		7046___~~%_~~--						---

- Identification of department and order distribution area ①

- Identification of a job ②

- Planned man-hours ③

- Starting and completion time ④

KOCKUMs

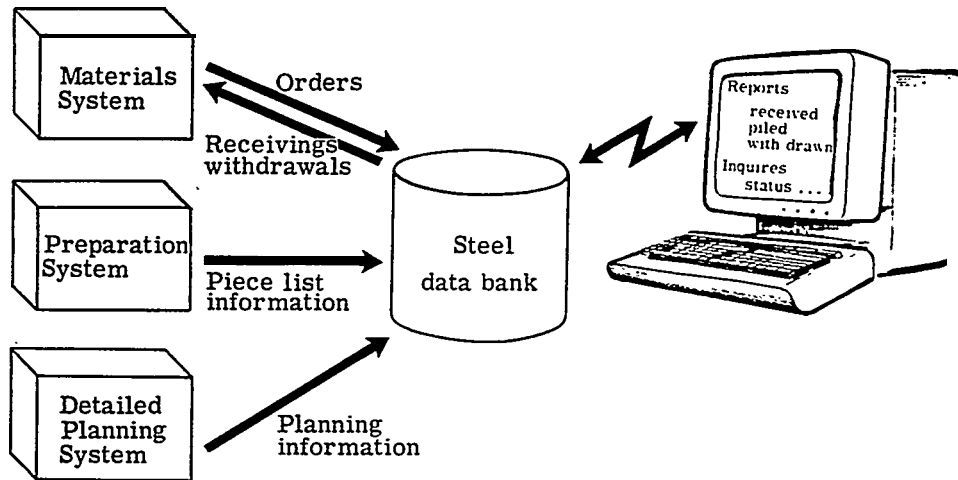## *Production situation for a work order ?*
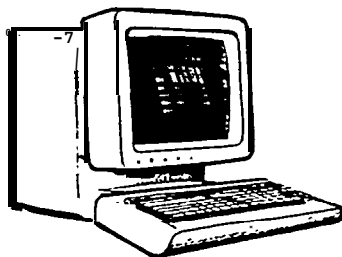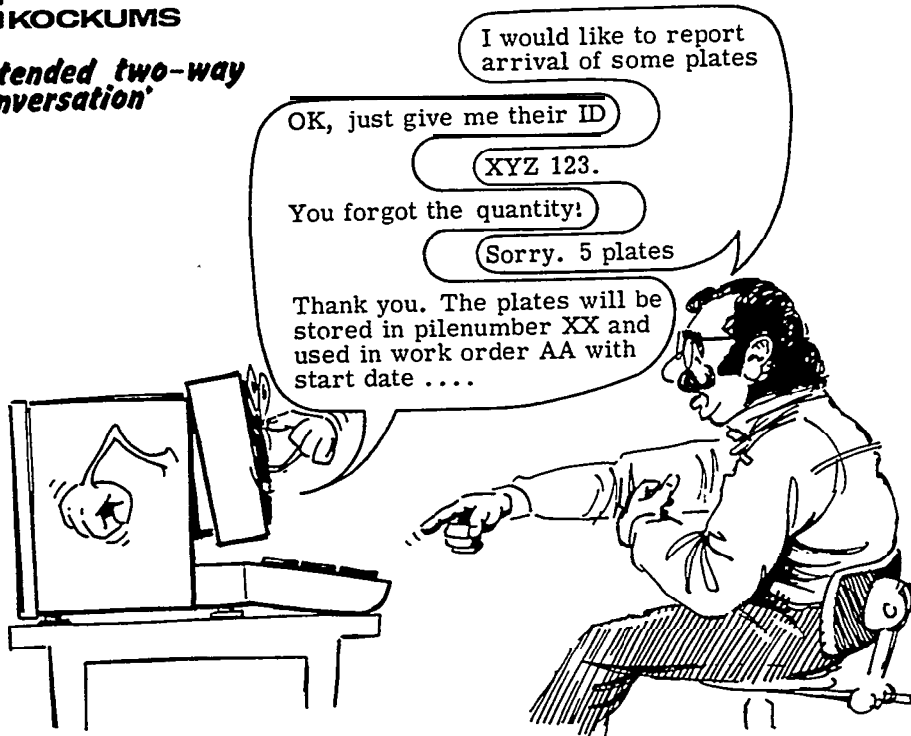
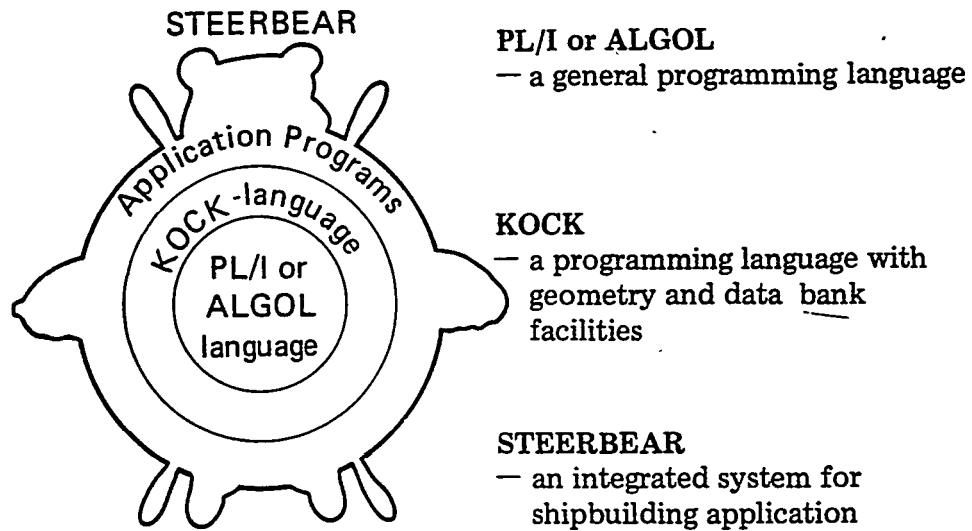**Planned, processed and remaining man hours**

Planned start-end

Actual start-end

Current status of operations

KOCKUMS

Steel administration system

KOCKUMS

Extended two-way 'conversation'

I would like to report arrival of some plates

OK, just give me their ID

XYZ 123.

You forgot the quantity!

Sorry. 5 plates

Thank you. The plates will be stored in pilenumber XX and used in work order AA with start date ....

STEERBEAR

PL/I or ALGOL
— a general programming language

KOCK
— a programming language with
geometry and data bank
facilities

STEERBEAR
— an integrated system for
shipbuilding application

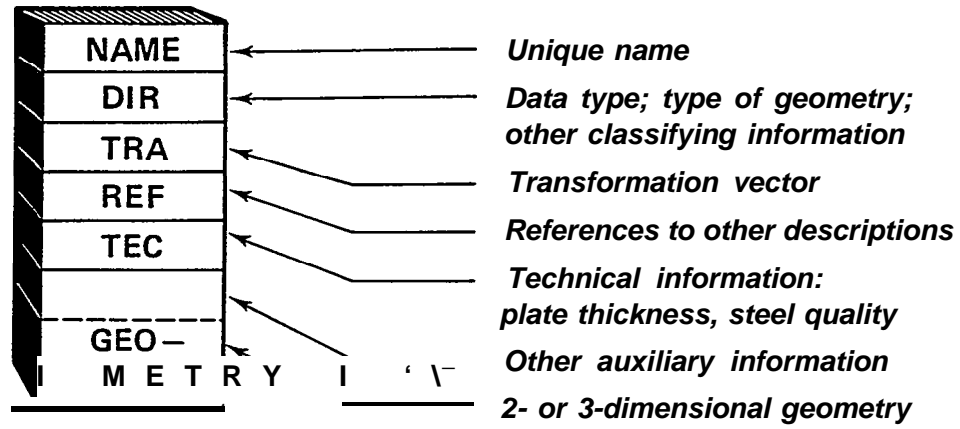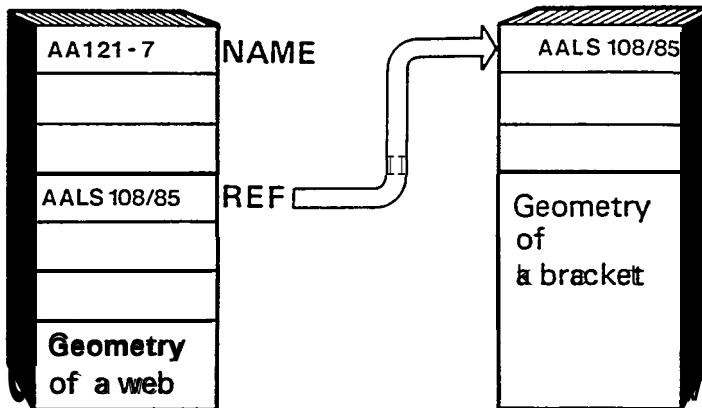*C 302*

Main features
of KOCK language

1 All PL/I or ALGOL available

2 Data base formats for
   ● Geometry
   ● Tables
   ● Arbitrary information

3 Extensive subroutine system for
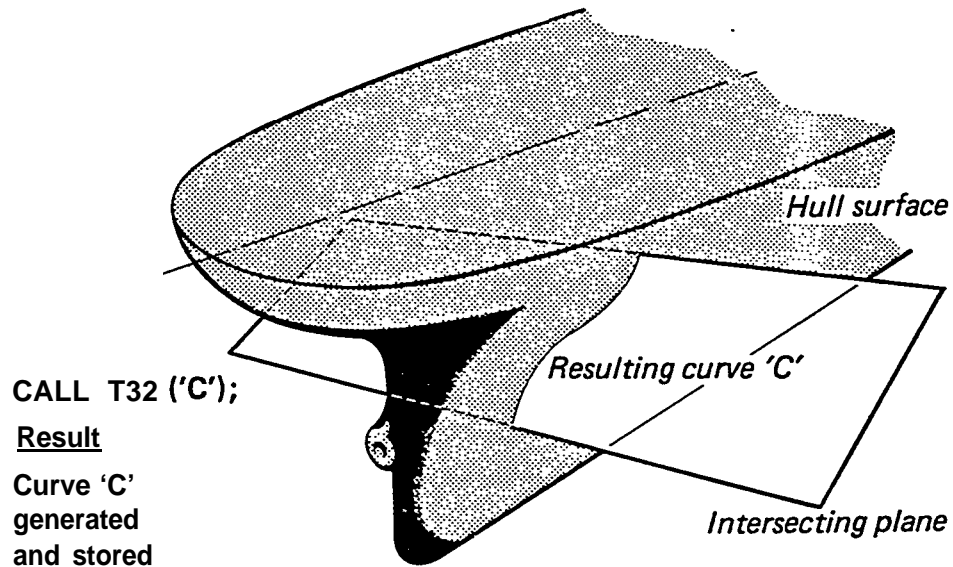   ● Data base operations
   ● Geometry and table handling

KOCK description in the data bank

NAME	*Unique name*
DIR	*Data type; type of geometry; other classifying information*
TRA	*Transformation vector*
REF	*References to other descriptions*
TEC	*Technical information: plate thickness, steel quality*
GEO—	*Other auxiliary information*
M E T R Y	*2- or 3-dimensional geometry*

GEOMETRY

u_2/v_2

h

SEGMENT

CONTOUR

u_1/v_1

c 305

Reference between **KOCK** *descriptions in the data bank*

AA121-7	NAME
AALS 108/85	REF
Geometry of a web	

AALS 108/85

Geometry
of
a bracket

Cut surface with plane

CALL T32 ('C');

<u>Result</u>

**Curve 'C'
generated
and stored**

Hull surface

Resulting curve 'C'

Intersecting plane

c 501

*Some typical
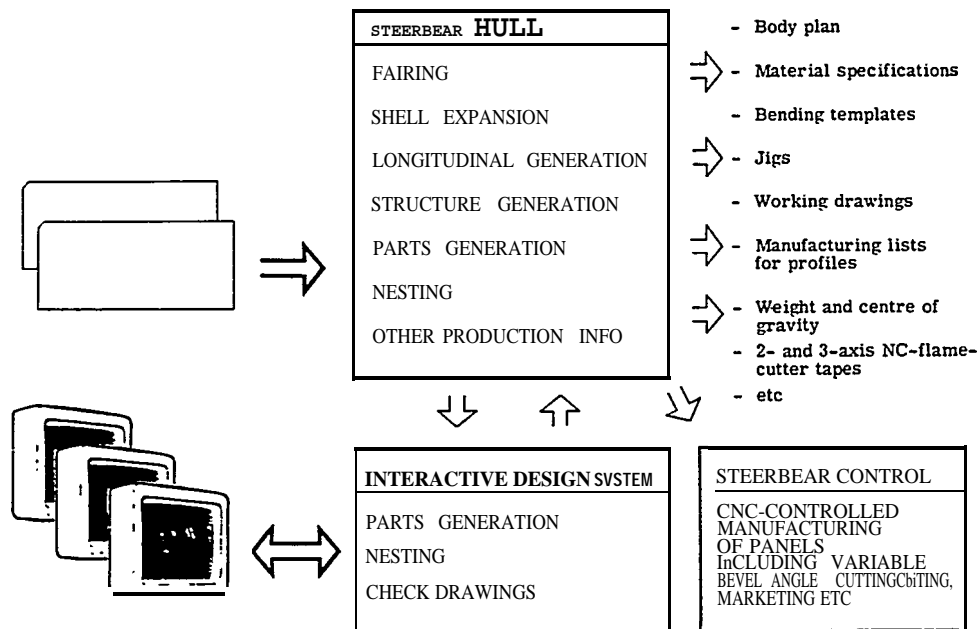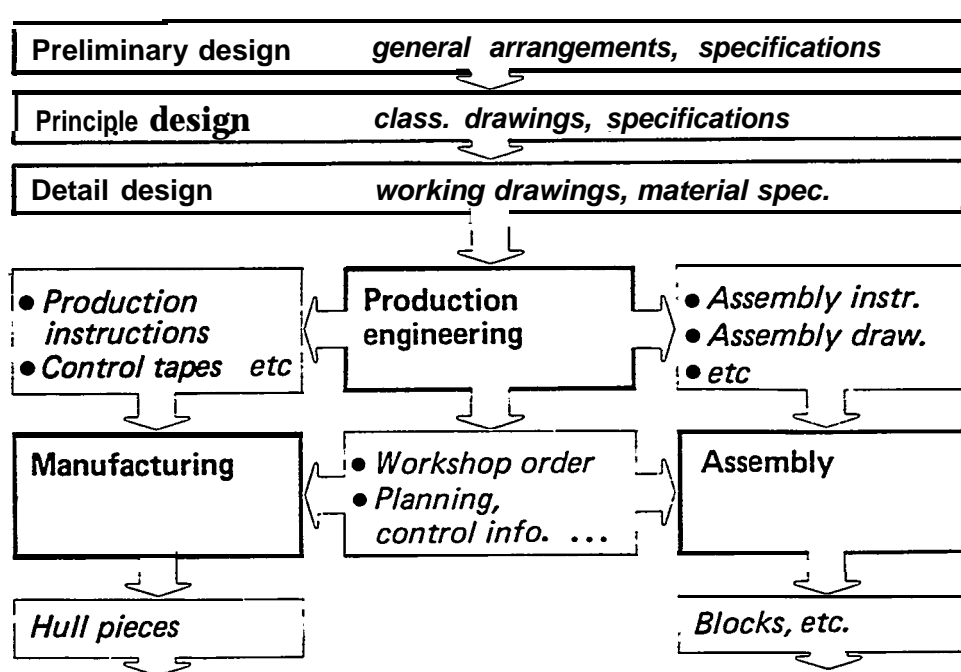application subroutines*

Hydromechanical
calculations

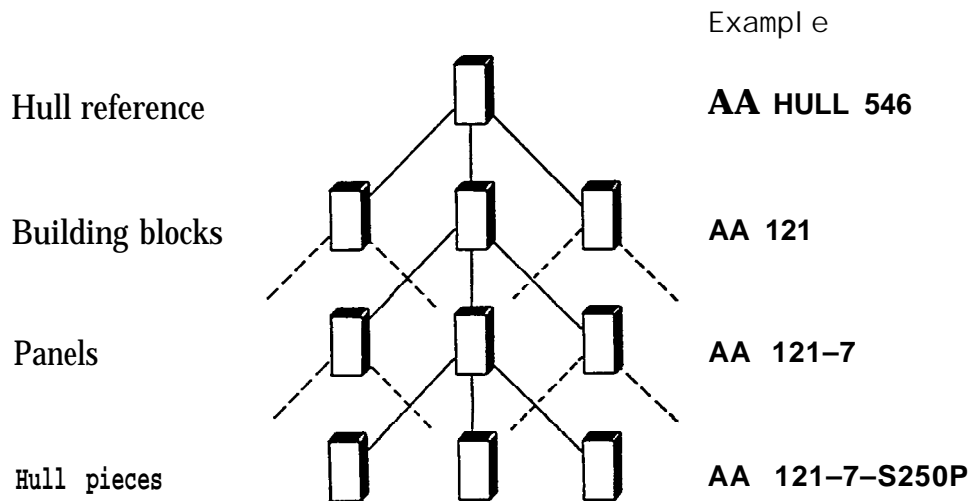- T61 — Moment of surface
- T64 — Simpson integral
- ...

Nesting

- PA3 — A nest
- PM18 — Along to corner
- PD1 — Draw text
- ...

Generation of
hull pieces
(micro design standards)

- T200 — Generate outer contour
- T232 — Set cutouts
- T300 — Tripping bracket
- ...

Principle flow – design and production

| Preliminary design | general arrangements, specifications |

| Principle design | class. drawings, specifications |

| Detail design | working drawings, material spec. |

- **Production instructions**
- **Control tapes** etc

Production engineering

- **Assembly instr.**
- **Assembly draw.**
- **etc**

Manufacturing

- **Workshop order**
- **Planning, control info. ...**

Assembly

| Hull pieces |

| Blocks, etc. |

KOCKUMS

STEERBEAR HULL	
FAIRING	- Body plan
SHELL EXPANSION	- Material specifications
LONGITUDINAL GENERATION	- Bending templates
STRUCTURE GENERATION	- Jigs
PARTS GENERATION	- Working drawings
NESTING	- Manufacturing lists for profiles
OTHER PRODUCTION INFO	- Weight and centre of gravity
	- 2- and 3-axis NC-flame-cutter tapes
	- etc

INTERACTIVE DESIGN SYSTEM	STEERBEAR CONTROL
PARTS GENERATION	CNC-CONTROLLED MANUFACTURING
NESTING	OF PANELS InCLUDING VARIABLE
CHECK DRAWINGS	BEVEL ANGLE CUTTINGCbiTING, MARKETING ETC

Hierarchy *in* data bank

Exampl e

Hull reference   **AA HULL 546**

Building blocks   **AA 121**

Panels   **AA 121–7**

Hull pieces   **AA 121–7–S250P**

C 506

Hull structure generation

Generation of panels	. Brackets
	● Scallops, cutouts, holes
	● Stiffeners, flanges
	● ...
... **can be done by**	● KOCK programming
	<u>or</u>
	● Structure programming
	● Micro design standards
... **based on**	● Special set of application subroutines
	● Structure data bank

Simple KOCK program

```
...
INITIATE KOCK (2000);
TREAT (<TESTEIT>);
POINT (200,100);
SEGMENT (0,425,100);
CIRCLE (-75,90,90);
SEGMENT (0,500,1050);
CIRCLE (50,90,90);
LINE WITH ANGLE (180,350);
LINE WITH ANGLE (270,500);
SEGMENT (0,200,100);
FOR V = 450,650,900 DO
IF V < 900 THEN
ADD CIRCULAR CONTOUR (300,V,50)
ELSE
ADD CIRCULAR CONTOUR (300,V,75);
NREA = 1;
REA (1) = 14.5;
PUT RECORD (<DIM>,2,-1);
KOCK DUMP (<TESTEIT>);
DRAW DESCRIPTION (<TESTE
TERMINATE KOCK;
...
```

KOCKUMS
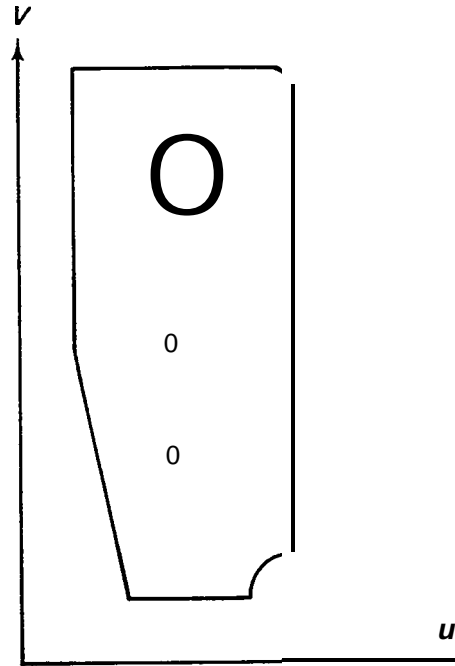
Panel boundaries
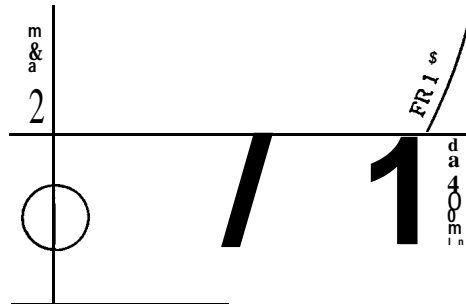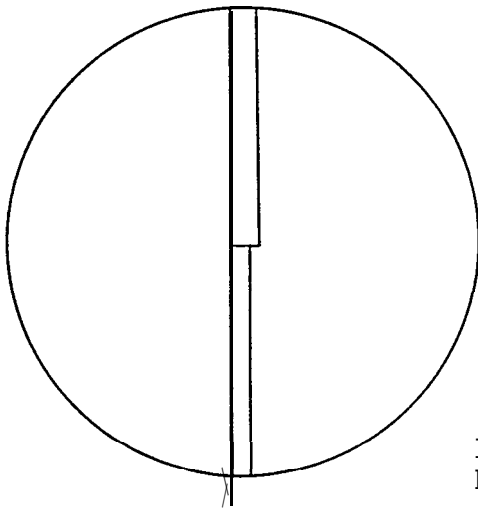
```
INPUT:
BOUNDARY, FR148/V=5200/'AG162-3'
```

Tripping bracket

Input:
- *Connection code*
- *Longitudinal number*
- *Thickness*
- *Side*
- *Quality*

Result:

*The bracket
generated and stored ·*

Web

Longitudinal
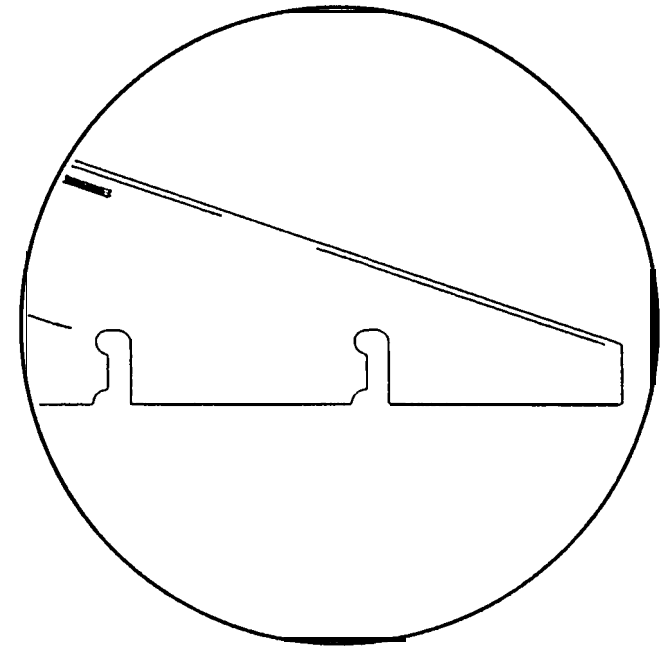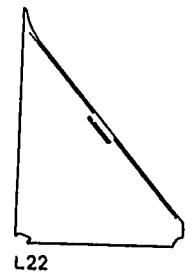
Flange

Stiffeners

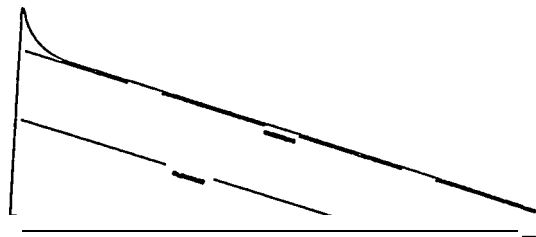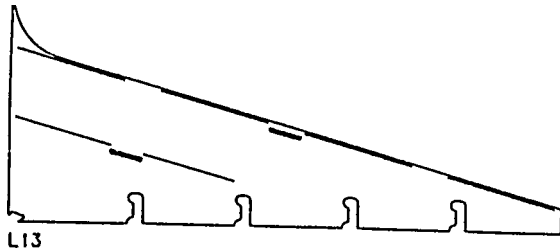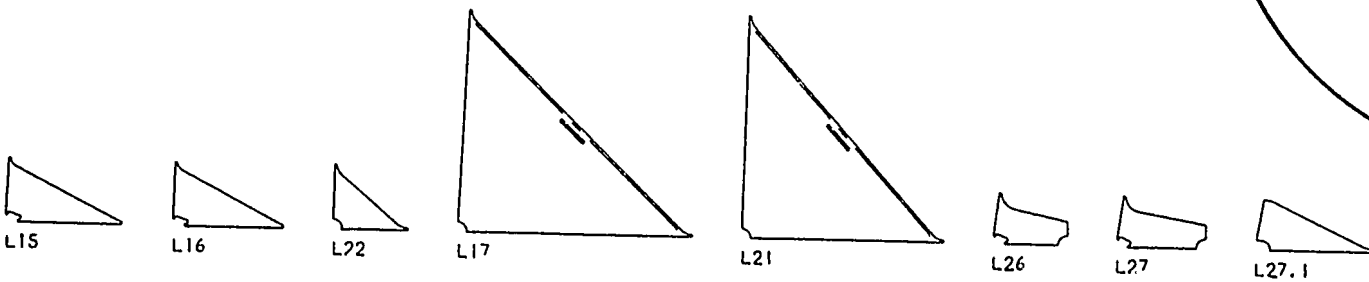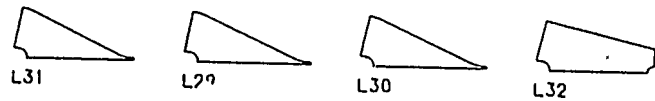**KOCKUMS**
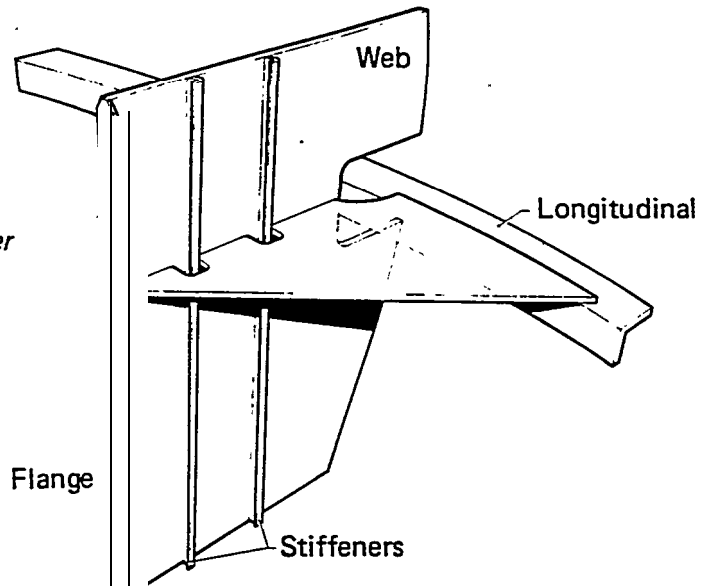
Special bracket

INPUT:

- References to longitudinal curve,
  surrounding panels, profiles etc.
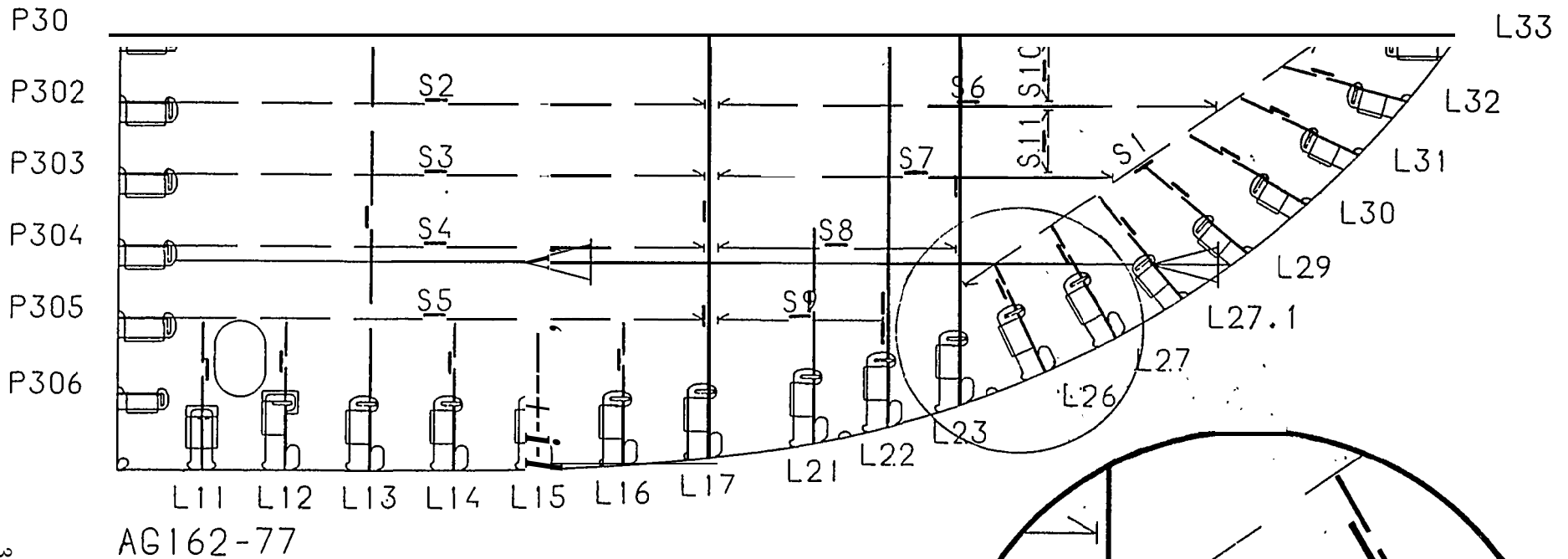- Some measurements
- Thickness
- Quality

RESULT:

The bracket generated and stored.

385

KOCKUMS

Result of structure programming

L31

L29

L30

L32

L15

L16

L22

L17

L21

L26

L27

L27.1

L13

L23

L22

AG162-77 BKT

KOCKUMS

P30 — L33
P302 — S2 — S6 S10 — L32
P303 — S3 — S7 S11 S1 — L31
P304 — S4 — S8 — L30
P305 — S5 — S9 — L29
P306 — L27.1
L27
L11 L12 L13 L14 L15 L16 L17 L21 L22 L23 L26

AG162-77
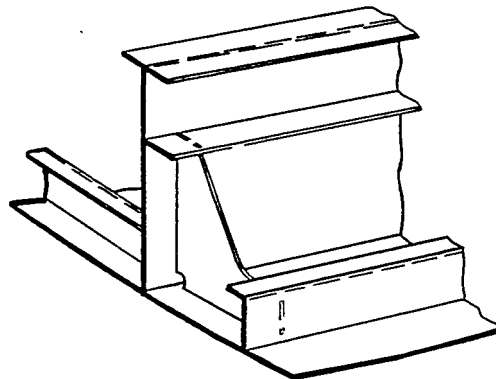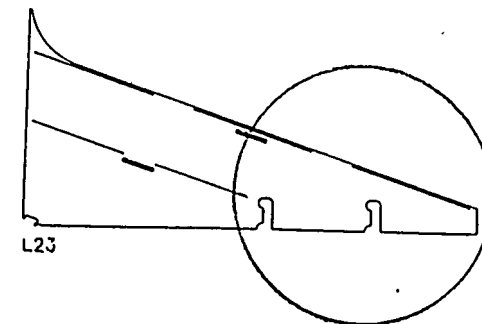
387

Result of structure programming

L26
23

KOCKUMS

Check drawing

KOCKUMS
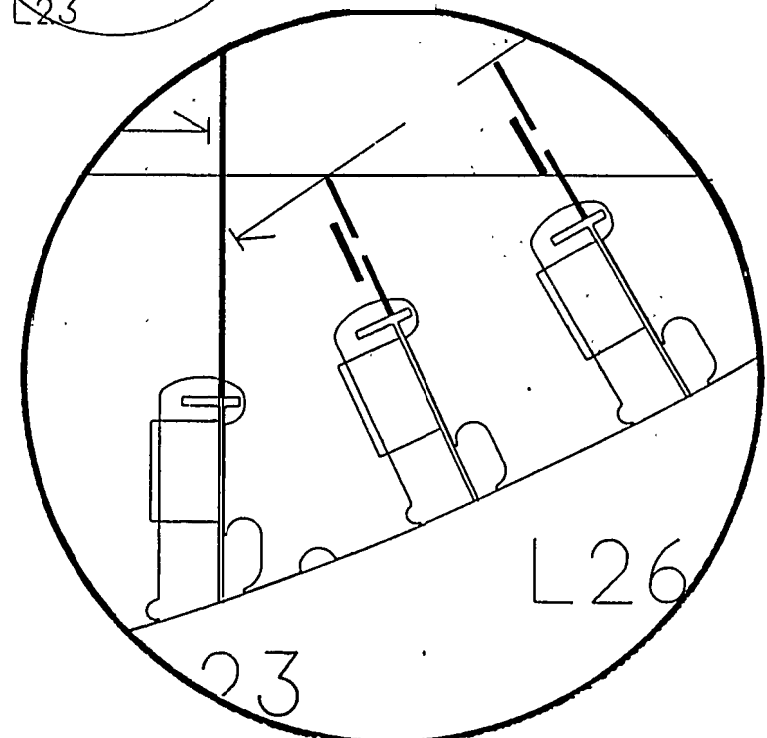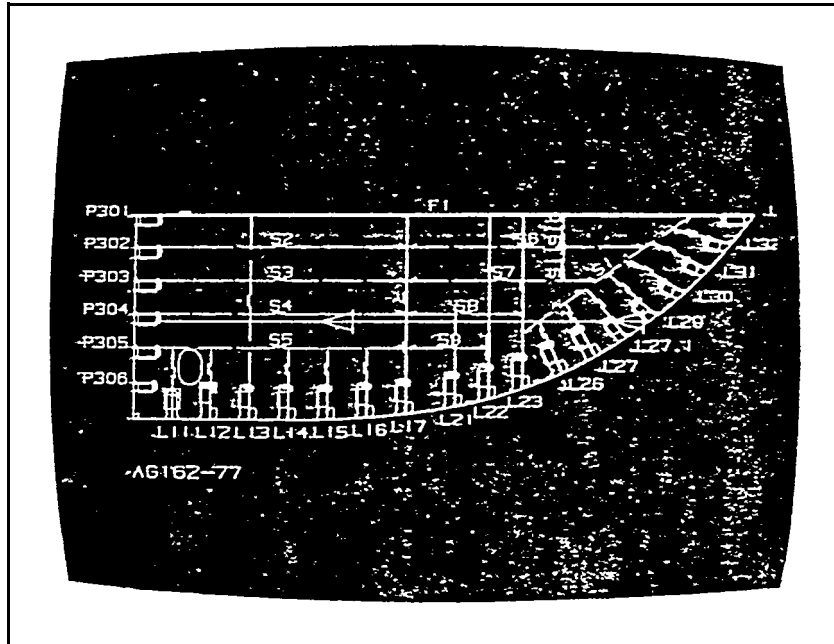
Identical panels
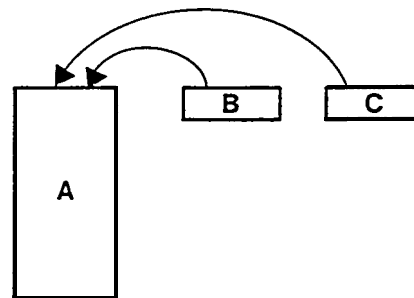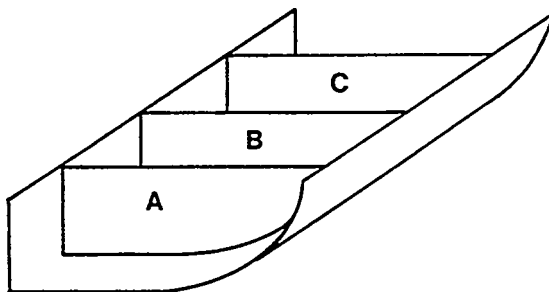
INPUT:

PANEL, 'B', 'C', EQUAL, 'A', X = FR252, FR255;

WORKING DRAWING

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Stiffeners

REF NR	POS NR	PROFIL TYP	DIM	PLAC	PLAC GRAD	DET
F1	0	PLS	450×20.0			
	1	P				N
54-55	2					N
56	1					N
57	1					N
58	5					N
810	1		:30×12.0			
811	A					

Brackets

REF NR	POS NR	BRICKA TYP STPL	VAR Y KVAL	PLAC	PLAC GRAD	DET	SB-VAR
L11		L5	112/51 -2° -15,0	AFT		H	
L12		L5	94/5 -20° -15,0			H	
L13	P1	A	454/1 -42° -12,5			A	-419-
L14						H	
L15	B5					H	
L16	B6					H	
L17	B2					B	-419-
	B8						-129-
L81	BV			7,5		F	-329-
L82	B4			6,6		G	-419-
	B7	B	60/50 -16° -15,0	7A,8			
L83	B9		3E0/1 -42° -12,5	75,6		C	-419-
L26	B10	A	50/40 -06° -12,5	76,6		K	
L27	B11	A	71/42 -06° -12,5	76,7		K	
L28	B13	B4	4 /40 -13° -12,5	7A,4		L	
L29	B14	B4	102/40 -30° -12,5	80,3		L	
L30	B15			82,7		L	
L31	B1	B4	78/40 -13° -12,5	84,3		L	
L32	BC	B4	94/40 -06° -12,5	86,5		M	
P801		B8×S140	-110-12,5	AFT		D	

Clips

REF NR	KLIPS B/L Y KVAL	DET
L11	10/37-15,0	
L82		
L83-L27		
L84-L?		
L87-L17	27/30-15,0	
L29-L32		
L33	27/47-15,0	
P301	27/47-15,0	
P302-P309	27/47-18,0	
P306	22/37-18,0	

VEB SPT °148
BB SIDA VISAD-SB LIKN

Detal märkning				
VEBSP °148	152	7		
Förbindningsritningar				
VEBRAME °148	120/132			

| A42 | |
| A402 | |

T.T 552

BOTTENVEB °148

623
TEL FORMAT
1682 A2 762S 1:100

KOCKUMS

Nesting: burning bridges

KOCKUMS
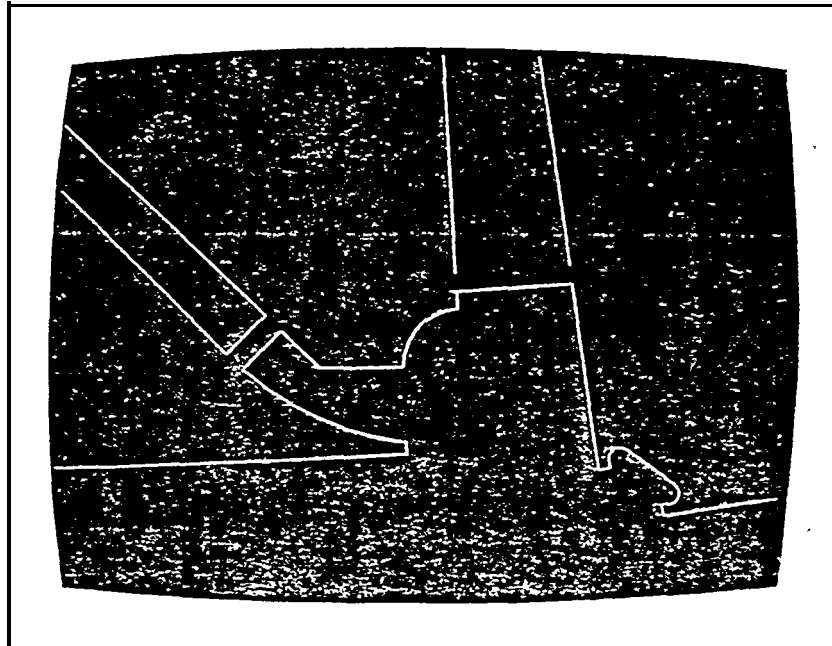
Complete nesting

Longitudinal bending table

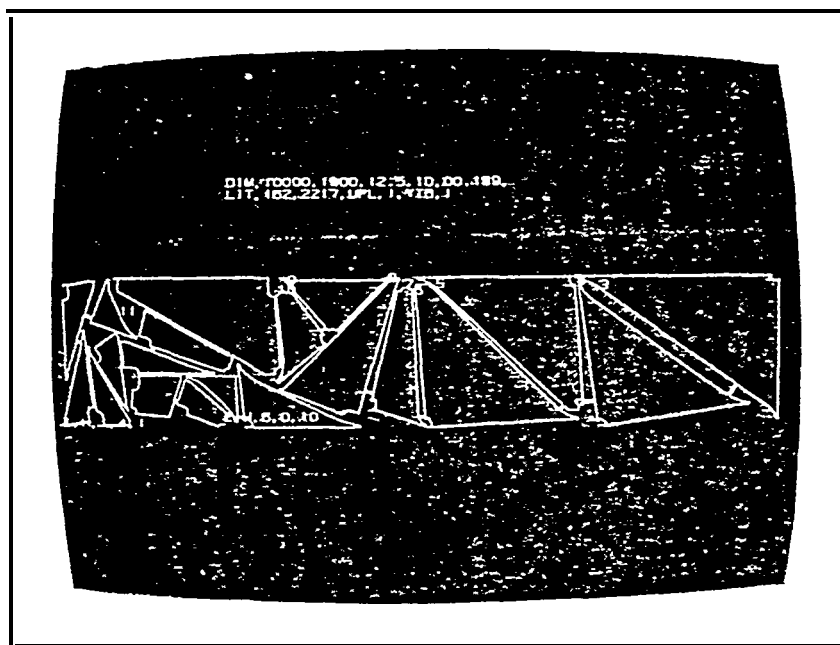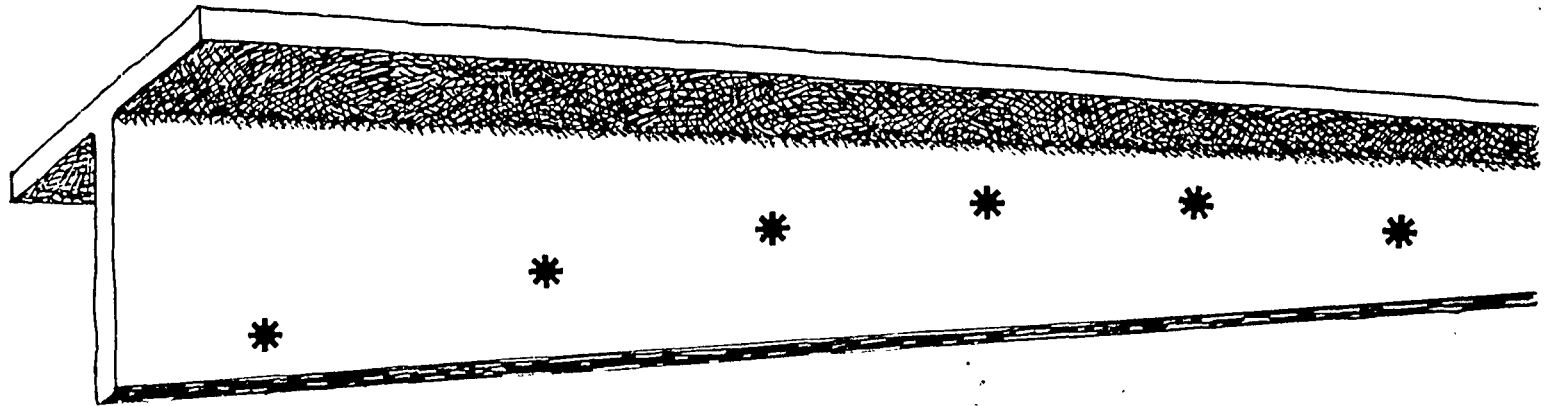| KOCKUMS MEKANISKA VERKSTADS AB	MÄRKLISTA FÖR LONGITUDINALER	RITNINGSNR	KALKYLNR	DKNR	VONR	PLE	SID
TS109A	1973-09-07	113/10146/-	510-546	113	1131	24202	1

```
                     / S B  / B B /          /              X  N  D  K  A  P  S  D  A  T  A
RNR-GNR-LNR  LANGD /DS AS /DS AS/  VIKT /     TYP   MÄRKES    A   B   C  R1  R2    V1  V2  V3    V4     FASL  FASF
=================================================================================================================
131-1-4        8800 /-- -- /--   1/  1066 / •1•  31      AKT              14  75        90,4  30  30  90,0
- - - - - - - - - - - - - - - - - - - - - - / •2•  31                     14  75        90,0  30  30  90,0
TYP/DIM: 43/660•200•13,5•35,0              /
                  ••••• H Å L •••••
HE150•75      V•53    U•960,1920,2880,3840,5600,6400,7200,8000
```

B O C K N I N G S T A B E L L 1

AVST	HUJO	AVST	HUJO	AVST	UUJO	AVST	HUJO
0	459	2500	465	5000	463	7500	4bQ
500	4b2	3000	4b5	5500	462	8000	460
1000	4b4	S500	464	6000	462	8500	459
1500	4b5	4000	464	b9Q0	461	0797	459
2000	4bS	4500	463	7000	461I		

B O C K N I N O S T A B E L L 2

AVST	HOJO	AVST	HUJO	AvST	HUJD	AVST	HUJO

KOCKUMS

SYSTEM Q STEERBEAR

MATERIALS PREPARATION PERSONNEL

PLANNING Kockums Computer Based Systems FINANCE

CONTROL HYDRO

PIPE HULL MACHINE

- Simplify and rationalize design work
- Check production restrictions on design automatically
- Minimize manual search in standards file
- Automate pipe sketch production
- Simplify changes in standards and design
- Minimize the manual effort to obtain complete production information
- Automate the calculation of cutting lengths, bending angles etc
- Produce automatically NC-tapes for bending machines
- Simplify sister ship handling

KOCKUMS

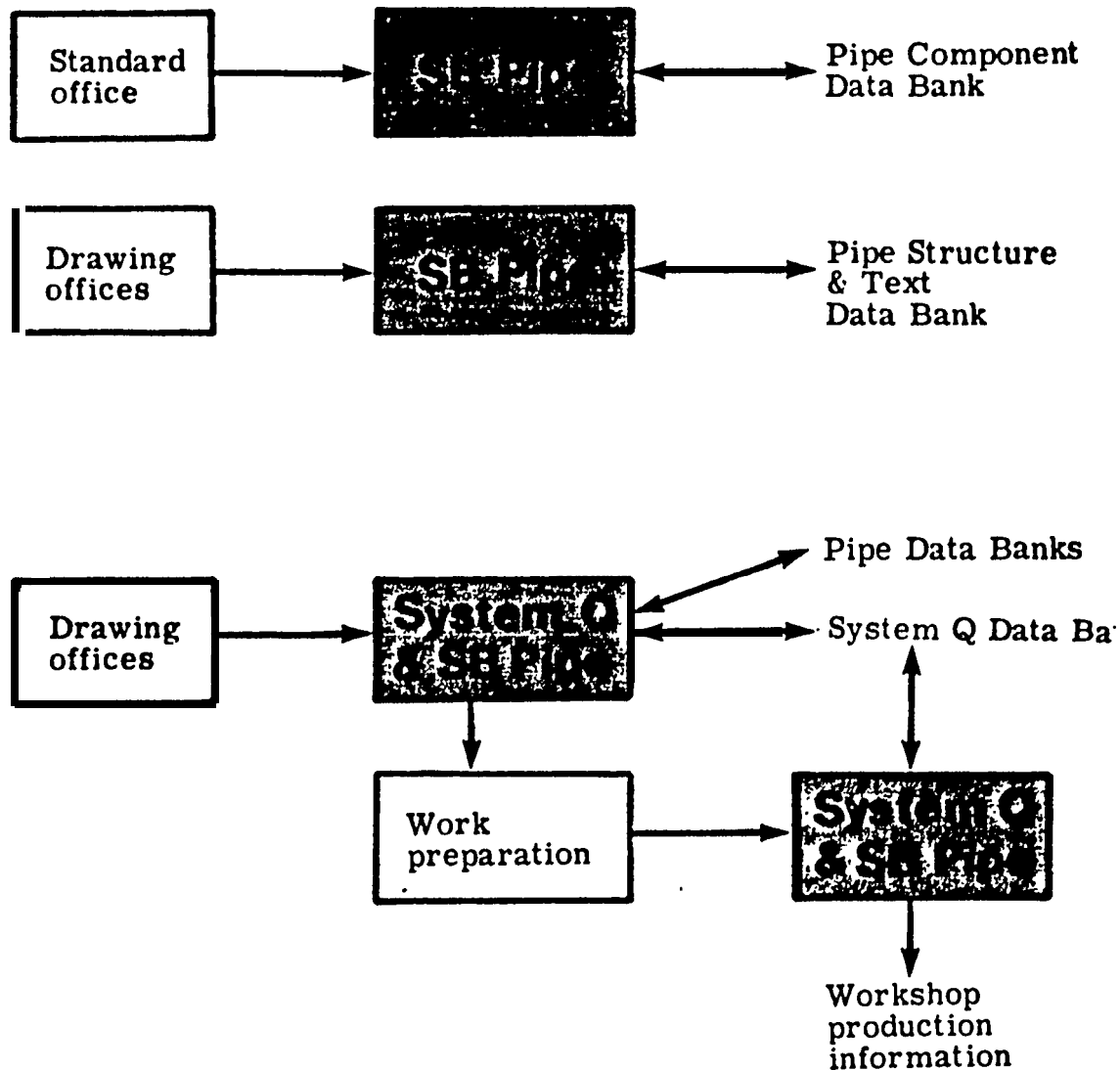*STEERBEAR PIPE*
— Main Activities

COMPONENT DEFINITION

DESIGN

- Initiation

- Scheme input

- Pipe Geometry Definition

PRODUCTION

- Work preparation information

- Workshop information

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Standard office	SB Pipe	Pipe Component Data Bank
Drawing offices	SB Pipe	Pipe Structure & Text Data Bank

Drawing offices → System Q & SB Pipe → Pipe Data Banks

System Q & SB Pipe ↔ System Q Data Ba

Work preparation → System Q & SB Pipe

Workshop production information

KOCKUMS

STEERBEAR PIPE
– Stored Flange Standard

KOCKUMS
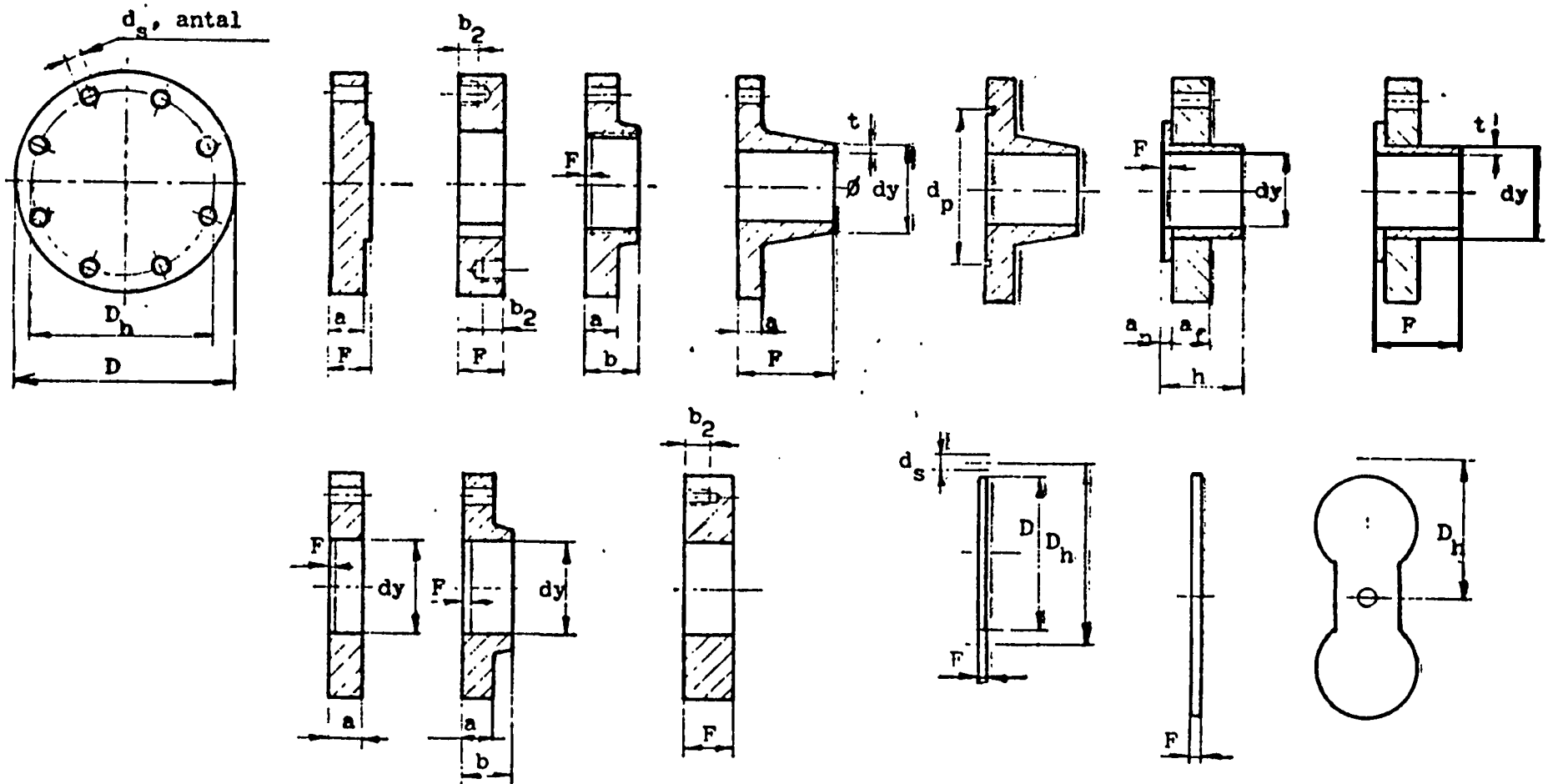
STEERBEAR PIPE
– Data Bank Structure

SHIP

BLOC×

COMPONENTS
AND PIPES

PIPE SYSTEM

KOCKUMS
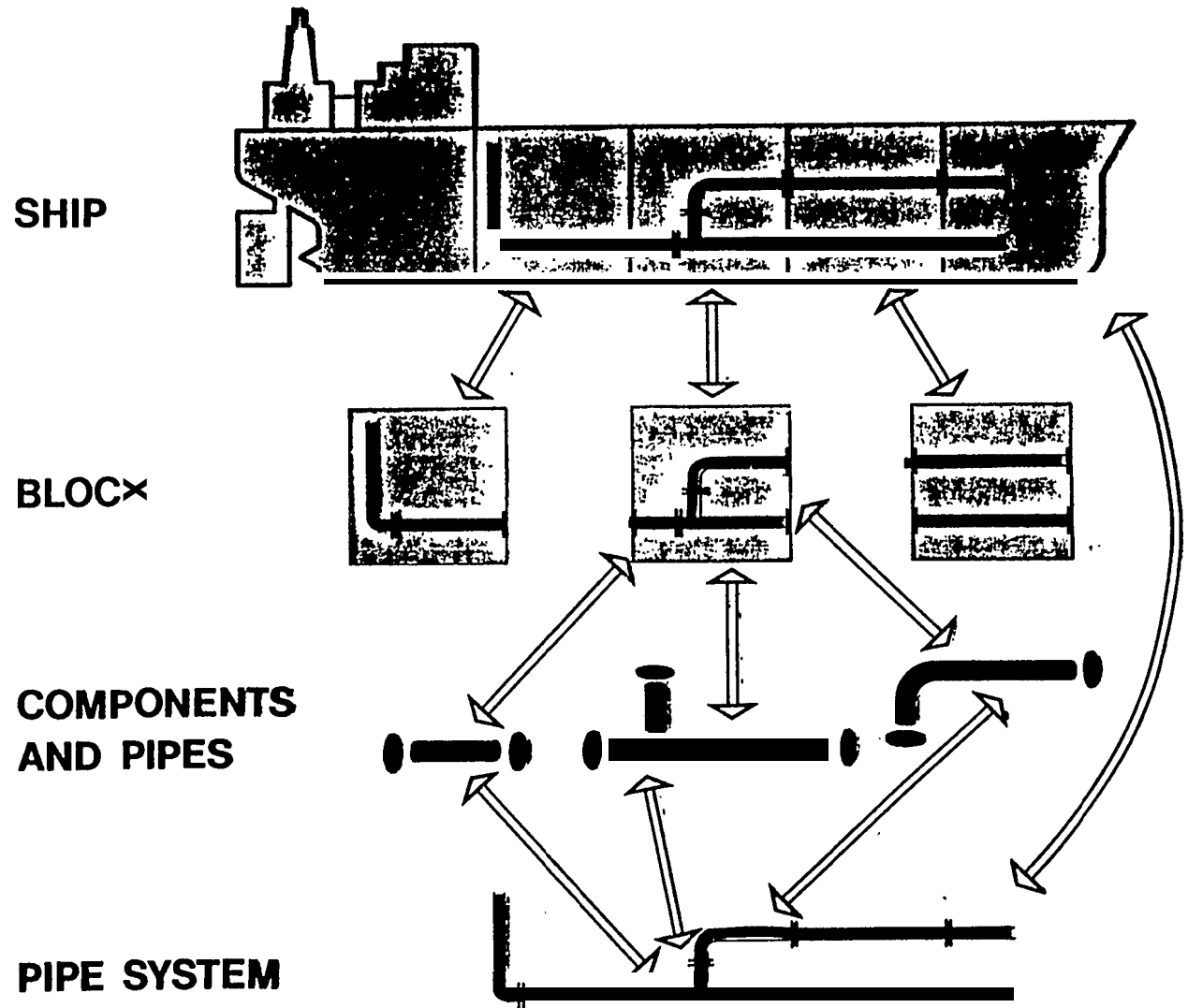
STEERBEAR PIPE
—Pipe Scheme Input

LIST OF VALVES AND FITTINGS

Item	Service	Qty	Size	Type	Material	Supplier/Type No	Code			
V12	Inert gas line waterseal	1	700		Cast iron		205-35454		519	
V13	Inert gas line waterseal	1	700	Butt fly	Cast iron		367-305215		519	
V15	Inert gas branch line	5	400	Hi-jet	steel		836-323767	V10		
V16	Inert gas branch line	1	300	Butt fly	Duct iron	JF 9980 B	207-348907	V10		1.85
V17	Inert gas branch line	5	250	Butt fly	Duct iron	JF 9980 N	207-348908	V10		1.75

V17	Inert gas branch line	5	250	Butt fly	Duct iron	JF 9980 N	207-348908

- **Item**   - **Quantity**   - **Type**   - **Supplier/Type No**
  - **Service**   - **Size**   - **Material**   - **Code**

Dept	Syst No	Hull				
6	625	510 985				
2	V3.7	V9 13	V14 19			
Date 6-02-04	Rev No.	List of valves and fittings Inert gas and tank venting system		Sheet No 1 of	List No. 831 150214

KOCKUMS

STEERBEAR PIPE
—Pipe Geometry Definition

UHN1- HN1

Position numbers

(deck curve)
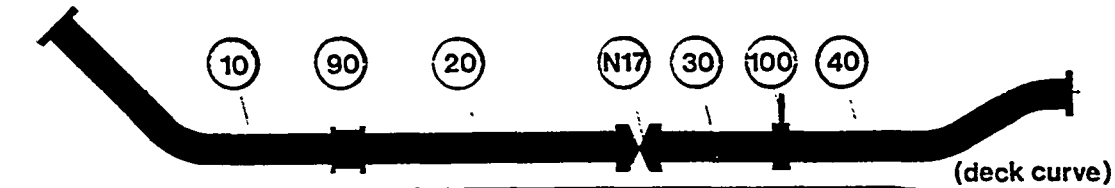
Component codes

F18	K43	F18	F18	F18
		HNV17	VNR ,233-348733	
		F18	F18	

KOCKUMS

STEERBEAR PIPE —Pipe Geometry Definition

Radar	30	Position	Läge	35	Components	Komponenter	Pos.nr	In
(1-5)	(6-25)			(30-70)			(71-77)	(78-80)
LEDN, HN1								
60 , 20R	273-8-133.0-24							
0	-215.0	,0DKA+14.0.2		AXSL, V				
				F18				
				RL				
	-1.75	,0DKA+118.0+D/2						2.0
				RL				
STP ,		,1579	,0DKA+118.0+D/2	K43			7.0	
				RL.56.0				22.0
				F18				
				HNV17				
		1221	,0DKA+258+D/2					
KN1+10 , GRADER				RITN , STK/—				
				RL				
		1967	,0DKA+69.0+D/2					
				RL				
SLP ,		1240	,0DKA+71.2+D/2	F18			Module	
995	10	625	K Smithberg	11	HXR	B UHN1	651995	

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KOCKUMS

STEERBEAR PIPE
— Piece List Draught

- **Pos. No.** on drawing
- **Id. of piece list on a lower level**
- **Id. of material**
- **Drawing No.**

170

190

R 831 50353 17

270 510

270 1292 RR

P 194

P 194 04 8

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KOCKUMS

STEERBEAR PIPE
– Pipe Sketch

IST PART

A ---- B ---- C ---- D -- -- E

ASSEMBLY PART